Date _____

Name Zamarud Shah

ID 7463

Subject Soil Mechanics

Submitted to Engr. Liqat Ali

Date 28/09/2020

ID 7463

Date

Q18- (A) Define the following:

Ans: (1) Isobar :- Line or curve which connect all the point below the ground surface having same vertical stresses. Isobar is useful for determine the effect of load on the vertical stresses at various points.

(2) Effectives Stresses :-
Effective stress equals the total stress minus the pore water pressure, or the total force in the soil grains divided by the gross cross sectional area which the force acts.

(3) Compaction :-
The process of bringing soil particles closer to a dense state by Mechanical means (Rolling, Tamping, vibration) with expulsion of air.
- Voids are reduce
- Unit weight is increased.

(4) Shear Strength :-
The resistance effect by the soil to the shear stresses before the failure of soil. it is termed as shear strength.

Date

(5) Shear parameters :- The shear strength parameters cohesion (c) and friction angle (ϕ) can be determined by different laboratory tests for different types of soils.

Q1 & (B) Write the assumptions of Boussinesq's theory and also explain its relation for 3 cases of pointed load.

Ans:-

In 1885 Boussinesq give a relation for the Calculation of verticle Stresses when the soil is subjected to concentrated / point load.

Assumption of Boussinesq theory :-

(1) The Soil Medium is elastic (The modulus of elasticity through out the soil sample)

(2) The soil medium is homogenous (The properties of soil are same at every point of the soil sample)

(3) The soil is isotropic (The properties of soil are same in every direction of soil sample)

(4) The soil sample is Semi-infinite (it is not total infinite)

Date

$$\delta_z = K_B \frac{Q}{z^2}$$

K_B = Boussinesq's influence

Q = intensity of load

z = Depth at which vertical stresses is to be calculated.

$$K_B = \frac{3}{2\pi} \left[\frac{1}{1+(r/z)^2} \right]^{5/2}$$

r = Radial distance from the line of action of load to the point at which we right calculation the verticles stresses.

Verticle stresses under circular area.

$$\delta_z = q + I_f$$

if $I_c = 1 - \frac{1}{\left\{1+\left(\frac{D}{2z}\right)^2\right\}^{3/2}}$

$$I.C = 1 - \frac{1}{\left(1+(r/z)^2\right)^{3/2}}$$

Date

Stresses due to line load.

$$\delta = \frac{2}{\pi}\left[\frac{1}{1+\left(\frac{x}{z}\right)^2}\right]^2$$

Vertical Stresses under a rectangular area.

~~Vertical Stress at~~

$$\Delta\delta = \int d\sigma = \int_{y=0}^{B}\int_{x=0}^{L} \frac{3qz^3(dx\,dy)}{2\pi(x^2+y^2+z^2)^{5/2}}$$

$$= qI_z$$

Where

$\Delta\delta$ = change in vertical stress

q = load per unit area.

z = Depth

Q28- (a)

Given data:-

$\because 1ml = 10^{-6} m^3$

$V = 65ml = 0.000065 m^3$

$W = 0.96N$

$W_d = 0.785N$

$G_s = 2.65$

Required :-

$S = ?$

Sol:- $\gamma_B = \frac{\gamma_w (G_s + e) S}{1 + e} \rightarrow (1)$

$\gamma_B = W/V = 0.96/0.000065$

$\gamma_B = 14769 N/m^3$

Date

~~$\gamma_w = 9800\ N/m^3$~~ (6)

$\gamma_w = 9800\ N/m^3$

$e = \frac{V_v}{V_s} \rightarrow (2)$

$\gamma_s = W_s / V_s \Rightarrow V_s = W_s / \gamma_s \rightarrow (3)$

$\Rightarrow \gamma_s = G_s \gamma_w$

$\gamma_s = 2.65 \times 9800$

$\boxed{\gamma_s = 25970\ N/m^3}$

Put the value in eq (3)

$V_s = 0.785 / 25970$

$\boxed{V_s = 0.000030\ m^3}$

$V = V_s + V_v \Rightarrow V_v = V - V_s$

$V_v = 0.000065 - 0.000030$

$\boxed{V_v = 0.000035\ m^3}$

Put the value in eq (2)

$e = \frac{0.000035}{0.000030}$

$\boxed{e = 1.167}$

Date

put the values in eq (1)

$$14769 = \frac{9800\,(2.65 + 1.167)\,S}{1 + 1.167}$$

$$1 + 1.167(14769) = 9800\,(2.65 + 1.167)\,S$$

$$S = \frac{1 + 1.167(14769)}{9800\,(2.65 + 1.167)}$$

$$S = \frac{32064.42}{37406}$$

$$S = 0.527 \text{ or } 52.7\%$$

End

Date

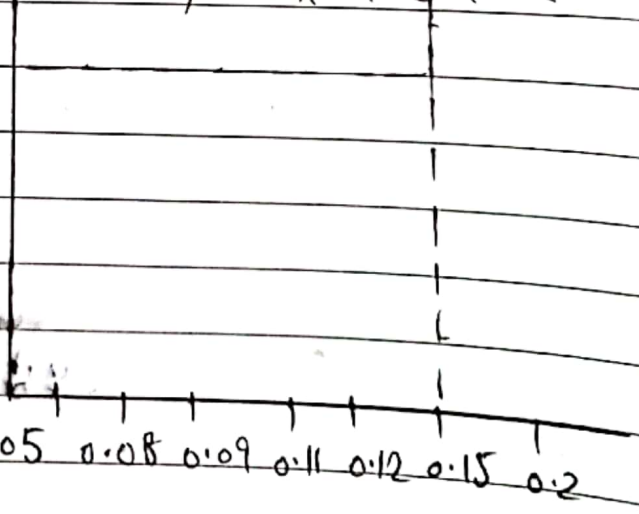
Q28- (b):-

Sol:-

Weight of the Sample (g)	Water Content (%)	Bulk unit weight (g/cm³)
~~1890~~	~~5~~	~~1890/950 = 1.989~~
1890	5	1890/950 = 1.989
2140	8	2140/950 = 2.253
2170	9	2170/950 = 2.284
2210	11	2210/950 = 2.236
2220	12	2220/950 = 2.337
2160	15	2160/950 = 2.274
2070	20	2070/950 = 2.179

γ_d (g/cm³)
1.894
2.086
2.095
2.095
2.086
1.977
1.816

Compaction Curve



γ_d = max value

Date _____

Q3:- (A) Explain CBR Test in detail as a soil investigation.

Ans:-

CBR :- The ratio of the force per unit area required to penetrate a soil mass with standard penetration plunger at a uniform rate of 1.25 mm/min to the corresponding penetration load of the standard material or crush stone is called CBR.

$$CBR(\%) = \frac{\text{Test load} \times 100}{\text{penetration load (standard material)}}$$

- This method is used to find out the strength of subgrade used for the design of road.
- it is developed by california state state of highway department
- In this method 5kg of soil specimen is taken. Then water is added to it until it reaches to OMC.
- Then the CBR mould is cleaned. Then mould is filled with prepared soil sample 1/3 part of the mould is filled. The layer is compacted by giving 56 blows distributed

Date _____

⑤ In this way the mould is filled in five layers after the 5th layer the excess of soil is struck off.

⑥ Then the mould which containing the soil specimen is placed by CBR machine load is applied in such away that the penetration load rate is 1.25 mm/min or 0.05"/min.

Standard load :-

(i) 0.1" penetration = 3000 lbs

(ii) 0.2" penetration = 4500 lbs

Q38- (B) Explain the following Methods in detail?

(1) Auger Boring :-

Simplest and most common method of boring from small projects in soft cohesive soil. Fast, economical light, inexpensive and flexible.

Auger is a drill for advancing holes.

① Has a shank with cross wise handle to apply torque.

② The length of auger blade varies from 0.3 - 0.5 m.

③ Diameter of central road almost 18 mm.

④ Auger held vertically and driven by apply torque, either manually or mechanically.

Date

(a) Driving force: Torque on handle + downward pressing force
(b) The auger is rotated until it is full of soil, then it is withdrawn to remove the soil. and the soil type present at various depth is noted.
(c) Hand Augers and mechanically operated auger.

(2) Test pits :-

(a) permits visual inspection of subsurface conditions of natural state.
(b) Max. depth limit to 18 - 20 feet.
(c) Especially useful for gravelly soil where the boreholes may be difficult.
(d) Sampling / testing done on exposed surface

(3) Wash boring :-

This is a method of removing loosened soil from the bore hole using a strong jet of water which is controlled mixture of fullers earth and water.

(e) This jet is sunk disintegrate and displace the soil and returns the disturb soil by way of returning water

Date

⊙ Progress downwards is made by the tube either sinking its own weight or being driven by monkey.

⊙ This method has the advantage of producing subsoil samples which has not been disturbed by impact of sampling shells.

⊙ Not suitable for large gravel or sub soils which contain boulders.

(4) Percussion boring :-

⊙ Consist of breaking up the formation by repeated blows from a bit or chisel.

⊙ Water the boring is in soil or into soft rock and provided that a sampler can be driven into them, cores may be obtained at intervals using suitable tools.

⊙ Water should be added to the hole at the time of boring, and the debris removed at interval.

⊙ ~~Stroke~~ Stroke of bit depends upon ground condition.
45-100 cm in depth @ 35-60 blow/m

Date

(5) probing :-

(a) It consist of rod.
(b) The dia of rod is 1/4 - 1"
(c) Having a handle at the top of apparatus for pushing in and out purpose.